

# Advanced Sensor Platform to Evaluate Manloads for Exploration Suit Architectures

Completed Technology Project (2016 - 2016)

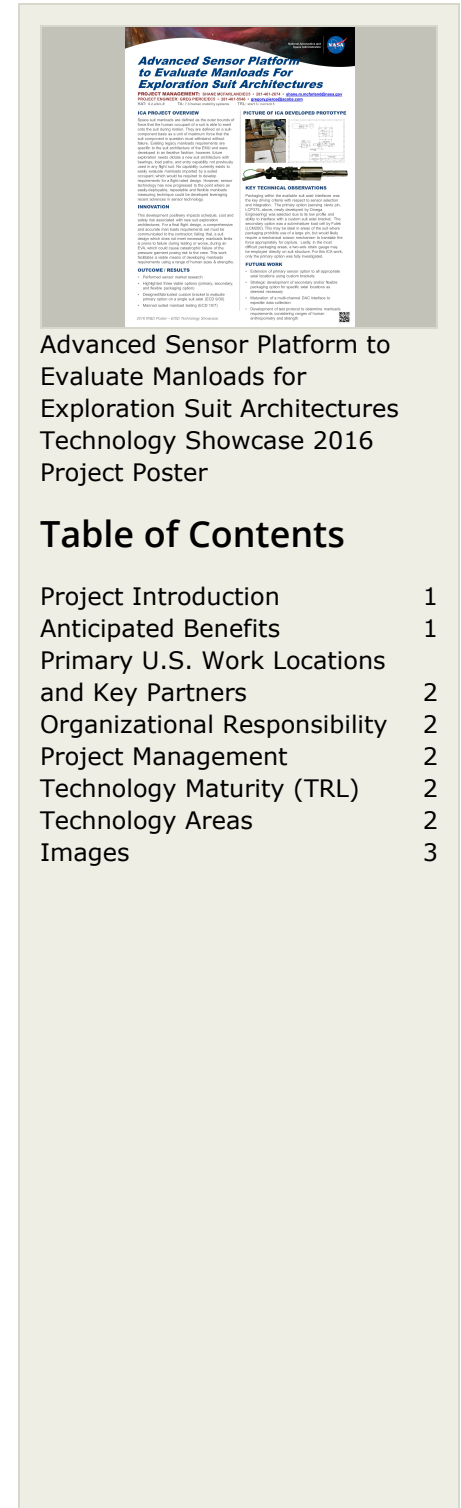


## Project Introduction

Space suit manloads are defined as the outer bounds of force that the human occupant of a suit is able to exert onto the suit during motion. They are defined on a suit-component basis as a unit of maximum force that the suit component in question must withstand without failure. Existing legacy manloads requirements are specific to the suit architecture of the EMU and were developed in an iterative fashion; however, future exploration needs dictate a new suit architecture with bearings, load paths, and entry capability not previously used in any flight suit. No capability currently exists to easily evaluate manloads imparted by a suited occupant, which would be required to develop requirements for a flight-rated design. However, revolutionary sensor technology has now progressed to the point where an easily-deployable, repeatable and flexible manloads measuring technique could be developed leveraging recent advances in sensor and DAC technology. This concept impacts both schedule, cost and safety risk associated with the new suit exploration architecture. For a final flight design, a comprehensive and accurate man loads requirements set must be communicated to the contractor; failing that, a suit design which does not meet necessary manloads limits is prone to failure during testing (posing schedule and cost risk) or worse, during an EVA, which could cause catastrophic failure of the pressure garment posing risk to the crew. By developing a platform for quickly and easily collecting manloads data during suited testing, it will facilitate a viable means of developing solid manloads requirements using a wide range of subject sizes and strengths. Doing so will also allow us to collect data on enough subjects to apply a statistical model and develop manloads requirements in conjunction with a statistical model to ensure sufficient margins are applied. The principal investigator has several years of experience in selection and testing of various sensor technologies and the incorporation of the same into a pressure garment. Also due to this experience, the most expensive required component, the data acquisition system for this type of work, is already owned by EC5. Therefore, the technical approach will be to conduct market research on the newest sensor technology specific for this purpose, procure samples to test in a laboratory environment, then proceed with design and accompanying software for analysis. A safety review will be conducted, and then manned testing using an advanced space suit prototype such as the Mark III or Z-2. The principle investigator will develop an innovative flexible prototype to measure manloads induced onto the suit by the occupant, therefore informing future requirements on manloads for new exploration spacesuit architectures. A final report will outline the sensors selected, the performance of those sensors, the design of the prototype and any associated software, the results of testing and the outcome of translating those testing results into a sample manloads requirement.

## Anticipated Benefits

N/A



Advanced Sensor Platform to Evaluate Manloads for Exploration Suit Architectures Technology Showcase 2016 Project Poster

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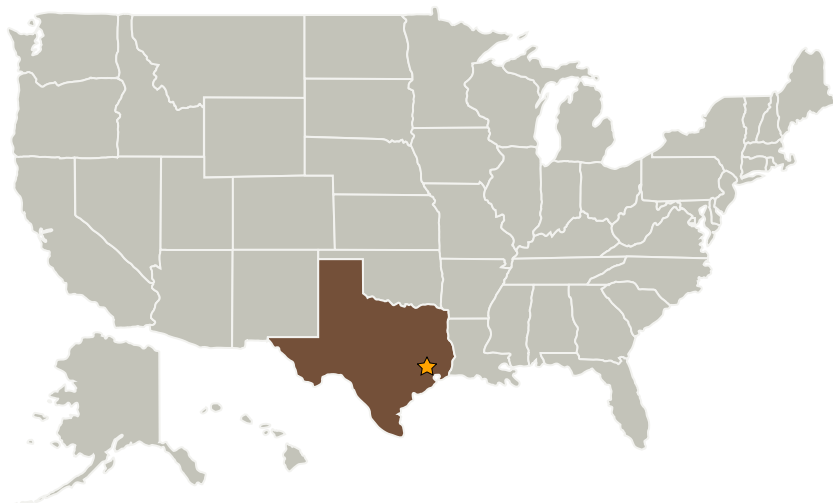
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas

### Primary U.S. Work Locations

Texas

## Organizational Responsibility

### Responsible Mission Directorate:

Mission Support Directorate (MSD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

Center Independent Research &amp; Development: JSC IRAD

## Project Management

### Program Manager:

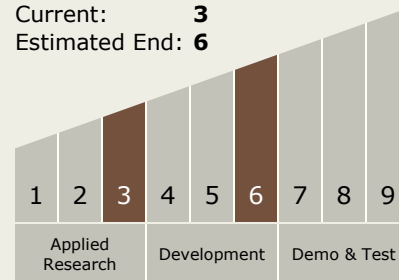
Carlos H Westhelle

### Principal Investigator:

Shane M Mcfarland

## Technology Maturity (TRL)

Start: 3  
Current: 3  
Estimated End: 6



## Technology Areas

### Primary:

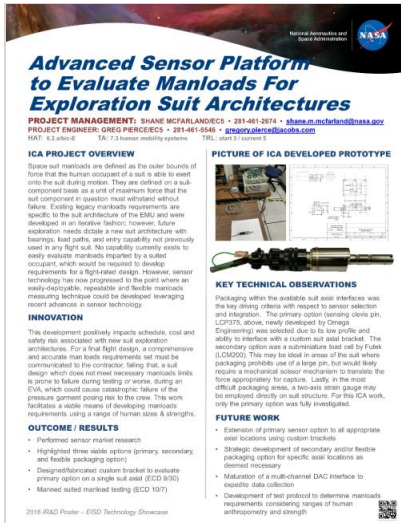
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## Images



## Advanced Sensor Platform to Evaluate Manloads for Exploration Suit Architectures Project

Advanced Sensor Platform to Evaluate Manloads for Exploration Suit Architectures Technology Showcase 2016 Project Poster (<https://techport.nasa.gov/image/26144>)

## Technology Areas (cont.)

- TX06 Human Health, Life Support, and Habitation Systems
  - ↳ TX06.3 Human Health and Performance
    - ↳ TX06.3.4 Contact-less / Wearable Human Health and Performance Monitoring